Huntington Lake Quadrangle, Central Sierra Nevada, California–Analytic Data

GEOLOGICAL SURVEY PROFESSIONAL PAPER 724-A

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By PAUL C. BATEMAN *and* DAVID R. WONES

SHORTER CONTRIBUTIONS TO GENERAL GEOLOGY

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Chemical, spectrographic, and modal analyses and potassium-argon age determinations on granitic rocks supplement Geologic Quadrangle Map (GQ–987)

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HUNTINGTON LAKE QUADRANGLE, CENTRAL SIERRA NEVADA, CALIFORNIA — ANALYTIC DATA

By Paul C. Bateman and David R. Wones

ABSTRACT

Samples of granitic rocks collected during the geologic mapping of the Huntington Lake quadrangle (Bateman and Wones, 1972) were chemically, spectrographically, and modally analyzed. The volume percentages of quartz, potassium feldspar, plagioclase, and mafic minerals and the bulk specific gravities of 314 samples are plotted separately and partly contoured on a simplified geologic base map to show zonal patterns within plutons. Chemical and spectrographic analyses of 31 samples and ternary plots of norms and modes indicate that the plutonic rocks range in composition from diorite or gabbro to felsic quartz monzonite. Potassium-argon determinations on biotite and hornblende yield ages that range from 82 to 90.3 million years. Many of these ages have been reduced as a result of reheating by younger intrusives. A map of conspicuous steeply dipping regional joints is included.

INTRODUCTION

The Huntington Lake quadrangle is about 40 miles northeast of Fresno, Calif., at middle altitudes of the long west slope of the Sierra Nevada, about midway between Yosemite and Kings Canyon National Parks. A geologic map of the quadrangle was recently published in the U.S. Geological Survey's map series as "Geologic Map of the Huntington Lake 15-minute Quadrangle, Central Sierra Nevada, California" (Bateman and Wones, 1972). This report supplements the quadrangle map in presenting analytic data — chemical, spectrographic, and modal analyses and potassium-argon age determinations — on samples of granitic rock collected during the mapping. It is part of a continuing series of investigations of the bedrock geology of the central Sierra Nevada batholith. Only aspects of the geology that bear on the interpretation of the analytic data are discussed here. A nontechnical summary accompanies the map; the geology of the central Sierra Nevada has been summarized in earlier reports (Bateman and others, 1963; Bateman and Wahrhaftig, 1966; Bateman and Eaton, 1967).

GENERAL GEOLOGY

The quadrangle is underlain chiefly by granitic rocks, but deformed and metamorphosed sedimentary rocks are present in the Dinkey Creek roof pendant in the central part of the quadrangle and in smaller bodies in the western and southern part (fig. 1). The most common metamorphic rocks are quartzite, marble, calc-silicate hornfels, quartz-biotite schist, and biotite-andalusite hornfels (Kistler and Bateman, 1966). These rocks are in the hornblende hornfels facies of contact metamorphism. The ages of the metasedimentary rocks are not known, but on the basis of lithologic characteristics and regional setting undoubtedly are Paleozoic or early Mesozoic.

The granitic rocks are in discrete plutons that are in sharp intrusive contact with one another. Where observed, contacts between plutons are steeply dipping or vertical. In composition, the plutons range from diorite and gabbro to felsic quartz monzonite. Most granitic rocks are medium grained (average grain size 2–5 millimeters), but rocks of some smaller bodies are locally fine grained. Porphyritic rocks are present locally and contain phenocrysts of potassium feldspar as large as 25 millimeters in greatest dimension. Some plutons are remarkably uniform in composition and texture; others are zoned. Many zoned plutons are progressively more felsic inward. A common zonal pattern has strongly foliated equigranular hornblende-biotite granodiorite containing abundant disk-shaped or weakly triaxial mafic inclusions in an outer zone that grades to an inner zone of slightly foliated or unfoliated porphyritic biotite-quartz monzonite containing no mafic inclusions.

Field observations of contact relations of plutons and petrologic and chemical criteria indicate that the granitic rocks in the Huntington Lake quadrangle belong to two intrusive sequences of somewhat different ages (Bateman and Dodge, 1970). Potassium-argon dating of the granitic rocks of the Sierra Nevada indicates that the older sequence is Early Cretaceous (121–104 million years) and that the younger sequence is Late Cretaceous (90–79 million years) (Evernden and Kistler, 1970). Over a broad region that includes the Huntington Lake quadrangle, granitic rocks of the Upper Cretaceous sequence lie generally northeast of the Lower Cretaceous sequence. Within the Huntington Lake quadrangle, Upper Cretaceous granitic rocks occupy the northeast corner, and isolated plutons believed to be Late Cretaceous have intruded Lower Cretaceous rocks farther west in the quadrangle.

ANALYTIC DATA

We attempted to collect not less than one sample per square mile from granitic terranes; but because the principal objective was geologic mapping rather than systematic sampling and because exposures are discontinuous, a regularly spaced pattern of sampling was not possible. In all, about 400 samples were collected. Of these, 314 samples of granitic rocks were analyzed modally, and 31 of these samples were analyzed chemically and spectrographically. The radiometric ages of biotite and (or) hornblende from 11 samples were determined by the potassium-argon method. Fission-track ages of biotite from two samples of granitic rock from the quadrangle have been published by Naeser and Dodge (1969), and many of our samples were used by Wollenberg and Smith (1968) in a study of radioactivity and heat production in the Sierra Nevada batholith. The data from these reports are not repeated here.

Modes were determined by counting 1,000–2,000 regularly spaced points on rock slabs no smaller than 6 square inches in which plagioclase and potassium feldspar were selectively stained. Four minerals or mineral groups were counted — quartz, potassium feldspar, plagioclase, and mafic minerals. Unfortunately, biotite and hornblende cannot be readily distinguished on stained slabs. In the central Sierra Nevada, however, granodiorite and quartz monzonite generally contain more biotite than hornblende, and rocks that contain 5 percent or less total mafic minerals rarely contain any hornblende.

The percentages of the modal constituents are plotted on simplified geologic maps (figs. 2–5). Also on the maps are such contours as seem justified. The contours were drawn by visual inspection, and alternate positions are possible in many areas. No attempt was made to contour all areas, and it is evident that additional data points would be required to do so. The modes, normalized to 100 percent, are plotted on ternaries whose corners are quartz, potassium feldspar, and plagioclase. Figure 8 shows plots of plutons of Late Cretaceous age, and figure 9, plots of plutons of Early Cretaceous age.

The bulk specific gravities are plotted on the same simplified base map as the modes and are partly contoured in a similar way (fig. 6). Vertical or steeply dipping joints also are plotted on the base map (fig. 7). The joints shown are prominent and readily visible on aerial photographs; they were transferred by visual inspection.

Chemical and semiquantitative data for chemically analyzed samples whose locations are shown in figure 1 are given in table 1, together with CIPW norms, modes, and bulk specific gravities. The norms, recalculated to 100 percent, are plotted on a ternary diagram (fig. 10) whose corners are normative quartz, orthoclase, and plagioclase (ab+an).

Potassium-argon age determinations for age-dated samples shown in figure 1 are given in table 2. Many of the ages shown in this table are consistent with the age assignments of the granitic rocks in the quadrangle, but some of them have been reduced as a result of reheating at the time of intrusion of younger plutons. The age assignments of the granitic rocks are based on data from a much larger number of samples, most of them collected outside the quadrangle (Evernden and Kistler, 1969).

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FIGURES 1–10 AND TABLES 1 AND 2

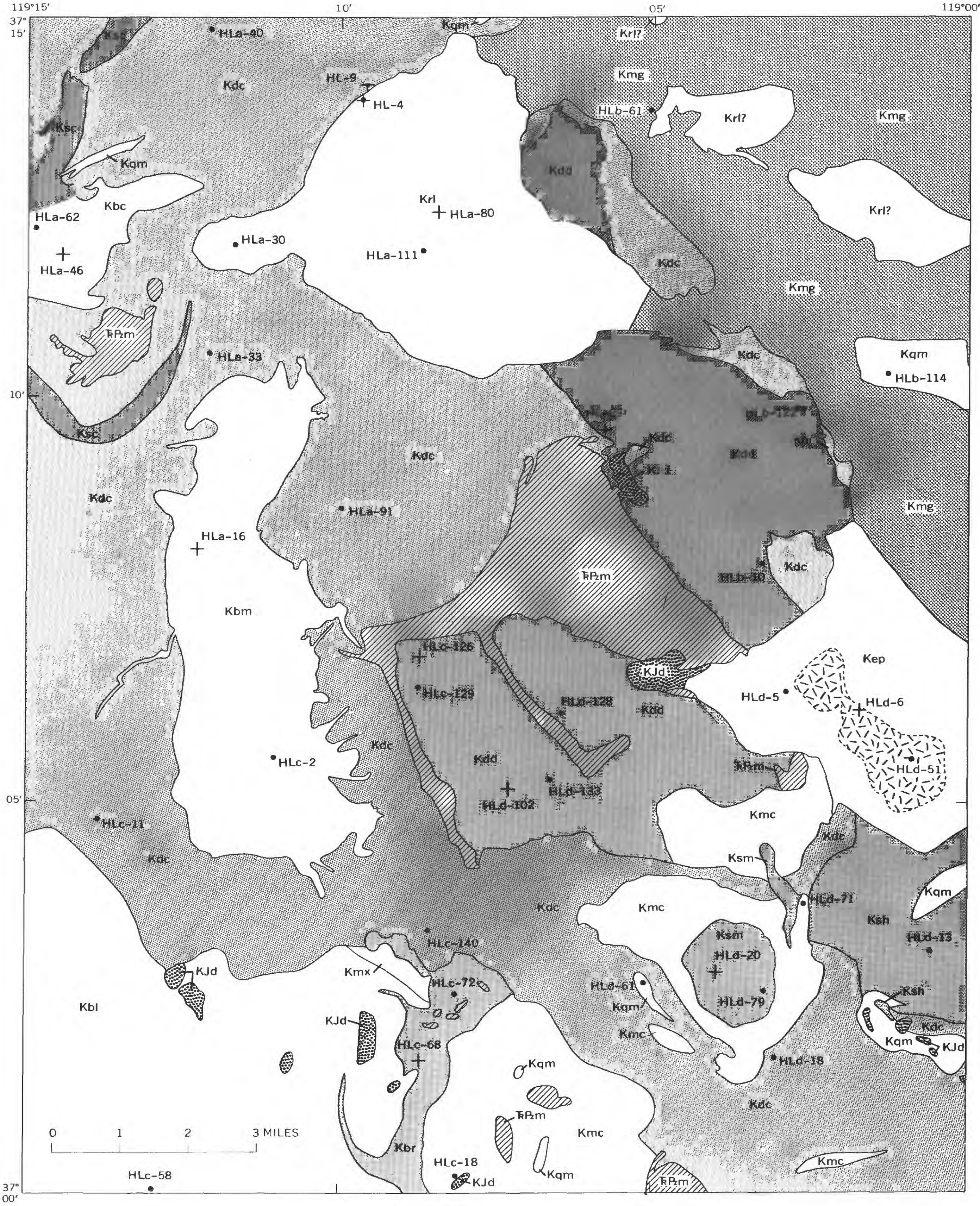

FIGURE 1. — Location of chemically analyzed samples (black dots) and

EXPLANATION

CRETACEOUS

Upper Cretaceous

Not in contact with one another; relative ages uncertain

Intrude Mount Givens Granodiorite

- Krl — Granodiorite of Red Lake
- Kep — Granodiorite of Eagle Peak. *Porphyritic facies shown by hachured pattern*

Intrude only rocks thought to be older than Mount Givens Granodiorite

- Kbc — Granodiorite of Big Creek
- Kbm — Quartz monzonite of Bald Mountain
- Kqm — Small bodies of medium- to fine-grained equigranular quartz monzonite

Kmg — Mount Givens Granodiorite

Lower Cretaceous

Not in contact with one another; relative ages uncertain

Older than Mount Givens Granodiorite

- Kdd — Quartz monzonite of Dinkey Dome
- Ksh — Quartz monzonite of Shorthair Creek

Minimum age not established

- Ksc — Quartz monzonite of Sheepthief Creek
- Kbr — Quartz monzonite of lower Bear Creek
- Ksm — Quartz monzonite north of Snow Corral Meadow
- Kmx — Mixed and hybrid rock

Kmc — Granodiorite of McKinley Grove

Kdc — Granodiorite of Dinkey Creek

Kbl — Quartz diorite of Blue Canyon

JURASSIC OR CRETACEOUS

KJd — Quartz diorite, diorite, hornblende gabbro, and other mafic plutonic rocks

PALEOZOIC OR TRIASSIC

ŦPzm — Metamorphic rocks

samples on which potassium-argon age determinations were made (plus signs).

476-248 O - 72 - 2

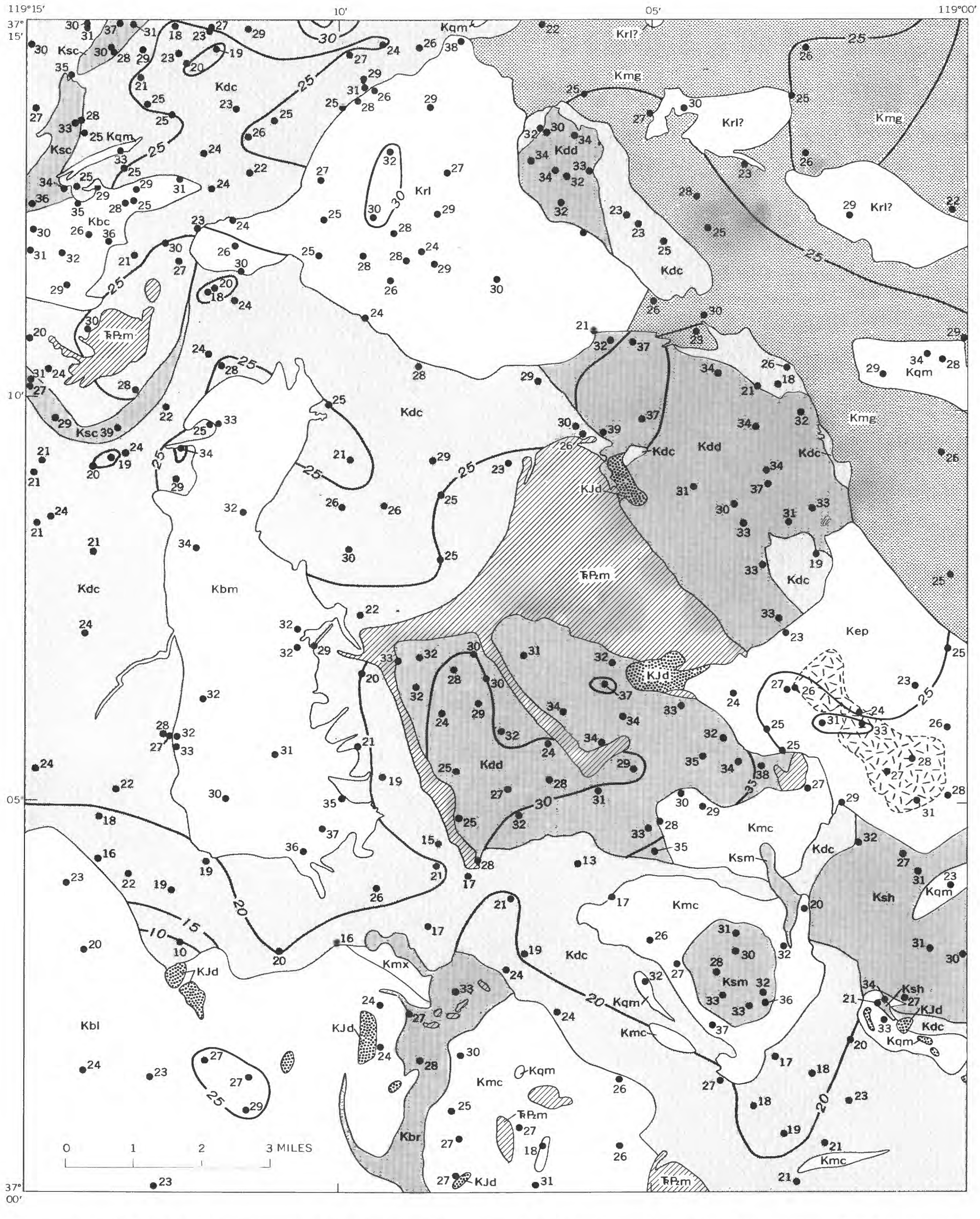

FIGURE 2. — Simplified geologic map of Huntington Lake quadrangle showing quartz, in volume percent. Explanation in figure 1.

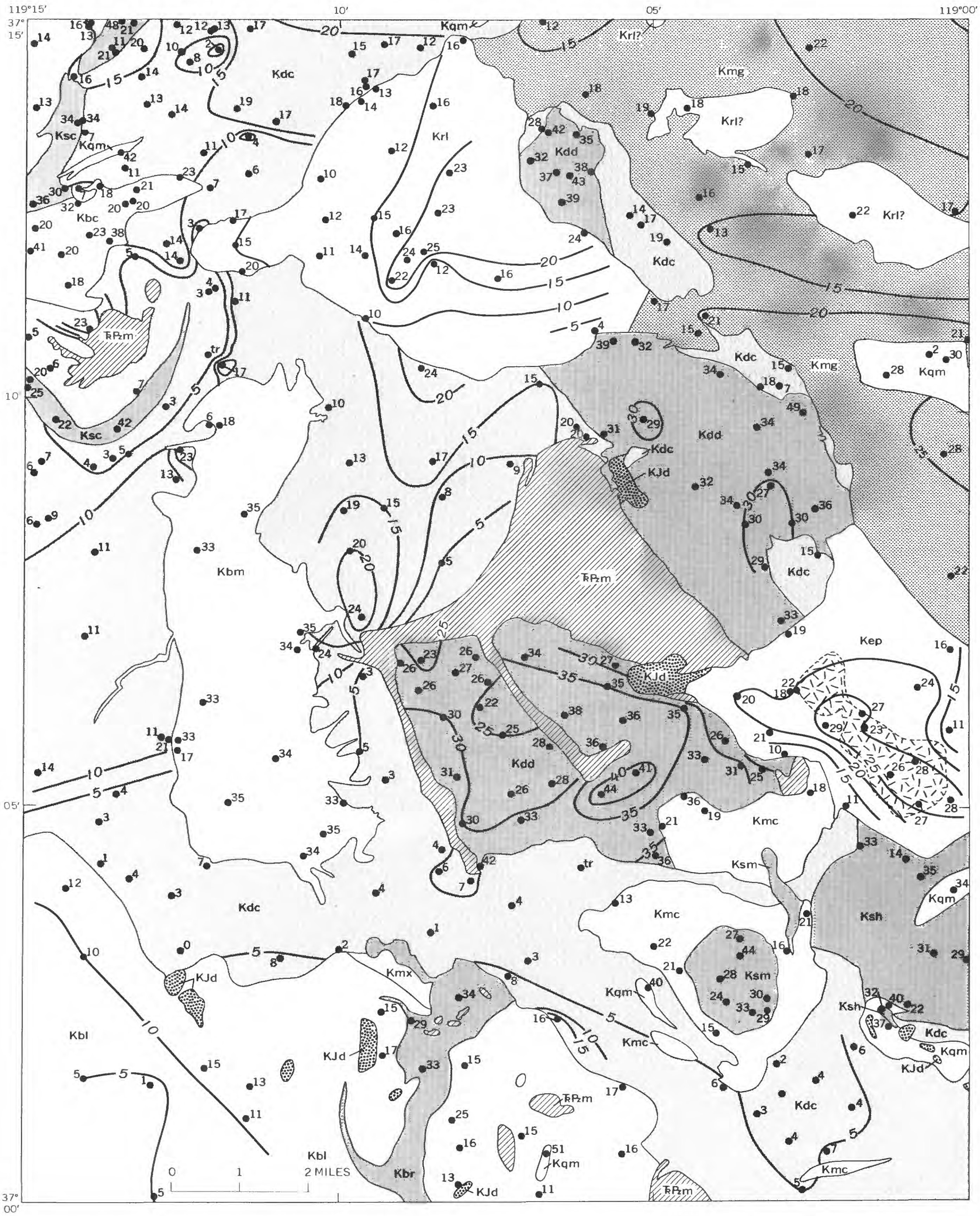

FIGURE 3. — Simplified geologic map of Huntington Lake quadrangle showing potassium feldspar, in volume percent. Explanation in figure 1.

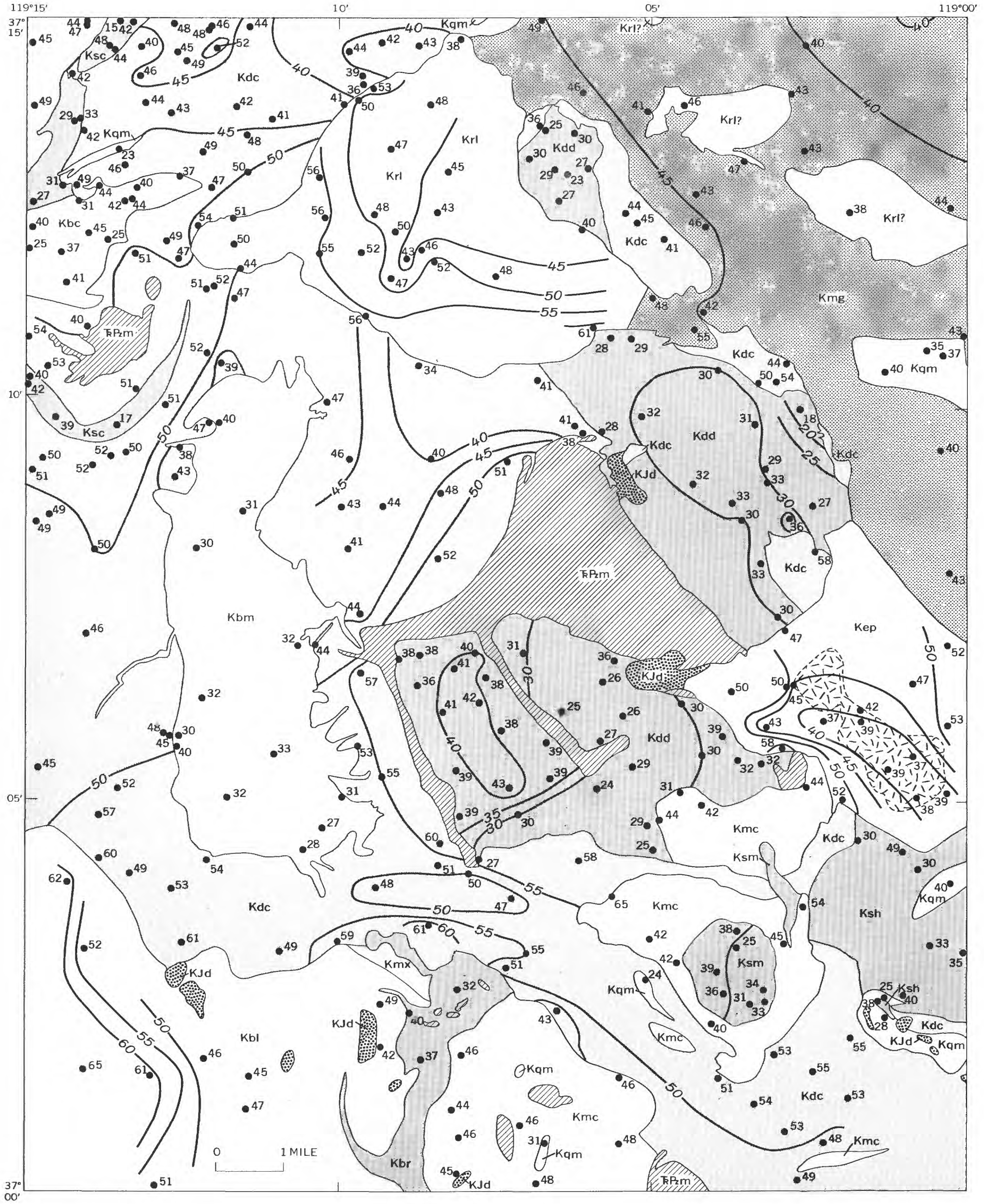

FIGURE 4. — Simplified geologic map of Huntington Lake quadrangle showing plagioclase, in volume percent. Explanation in figure 1.

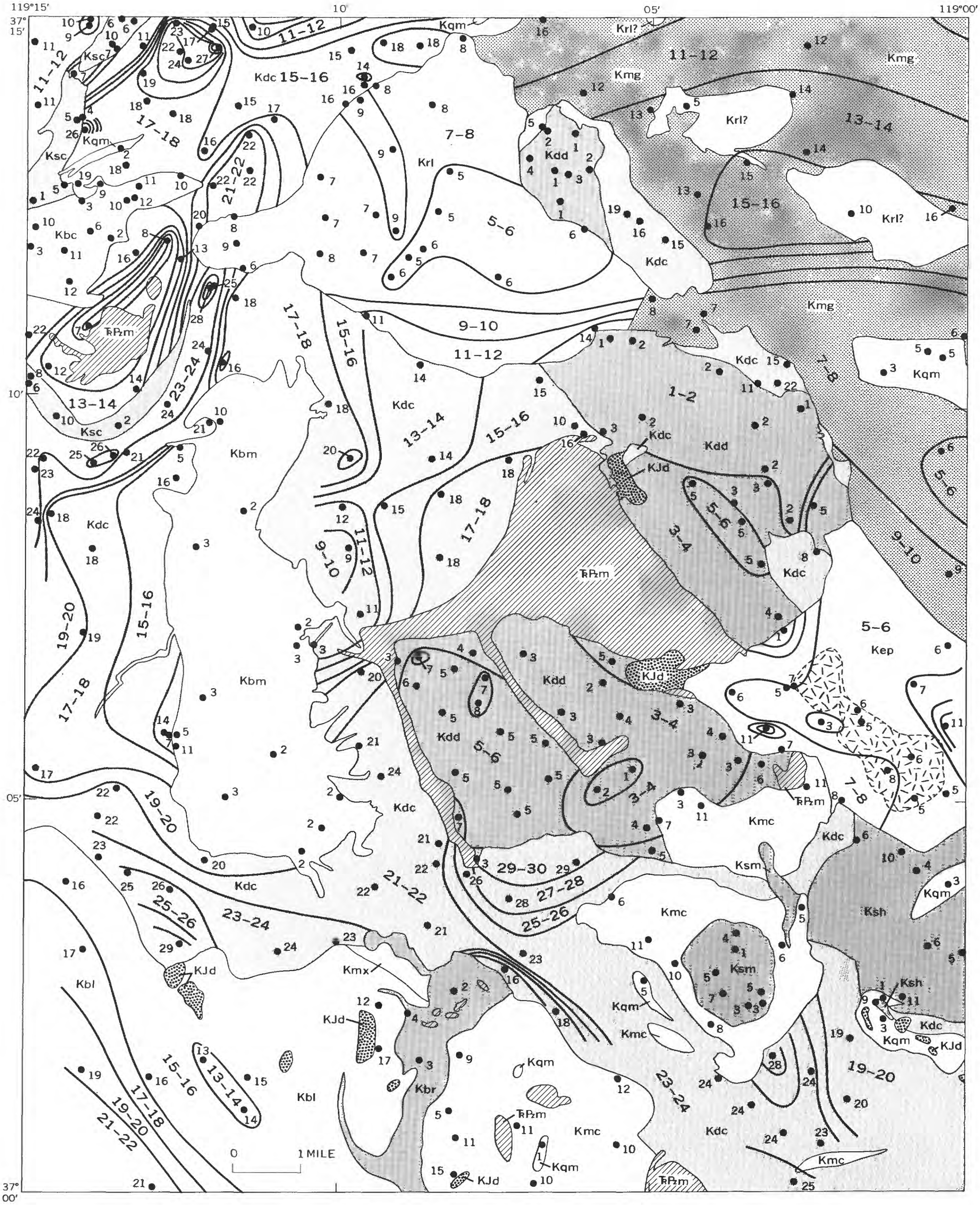

FIGURE 5. — Simplified geologic map of Huntington Lake quadrangle showing mafic minerals, in volume percent. Explanation in figure 1.

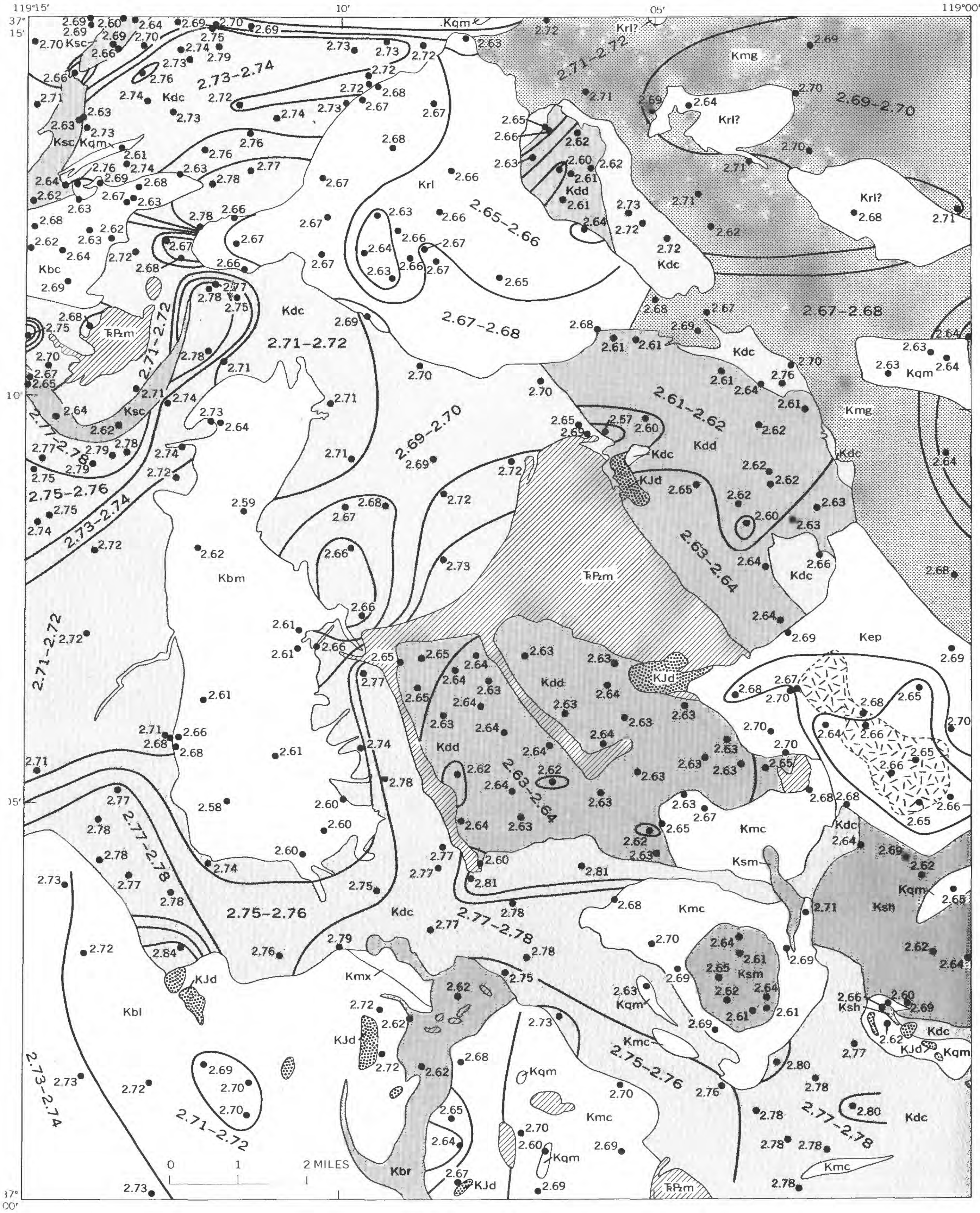

FIGURE 6. — Simplified geologic map of Huntington Lake quadrangle showing specific gravity. Explanation in figure 1.

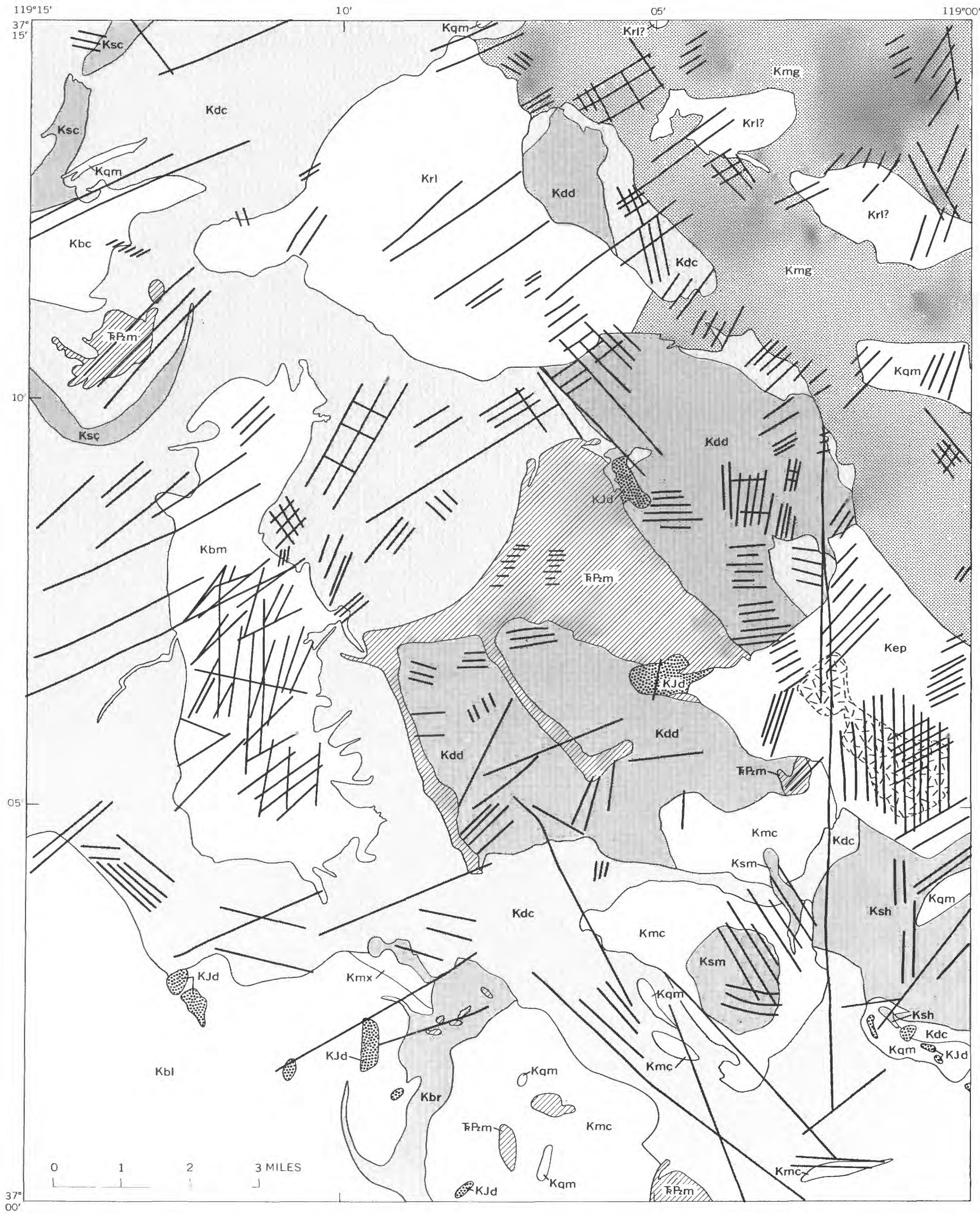

FIGURE 7. — Simplified geologic map of Huntington Lake quadrangle showing steeply dipping regional joints. Explanation in figure 1.

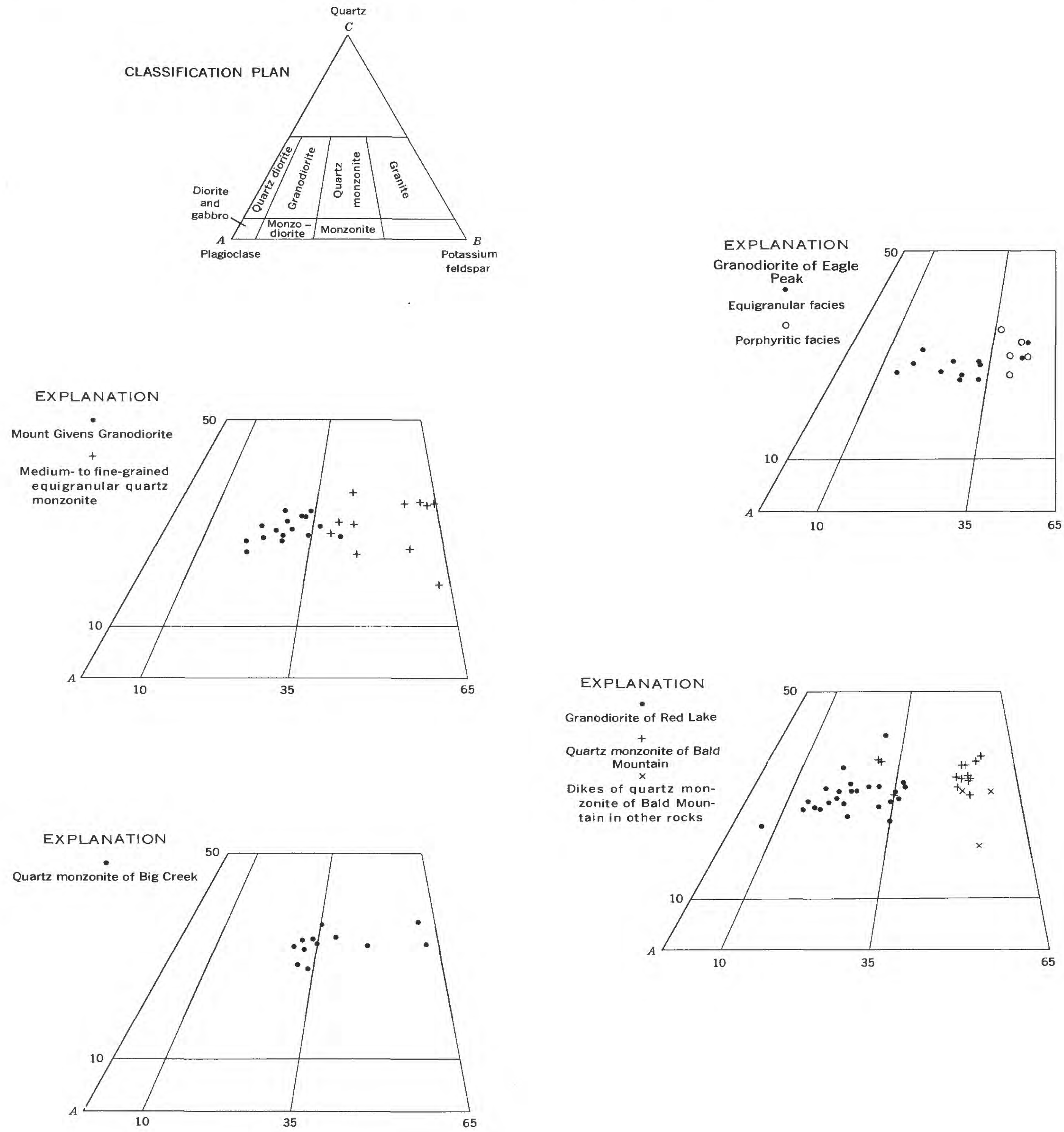

FIGURE 8. — Plot of modes for Upper Cretaceous granitic rocks.

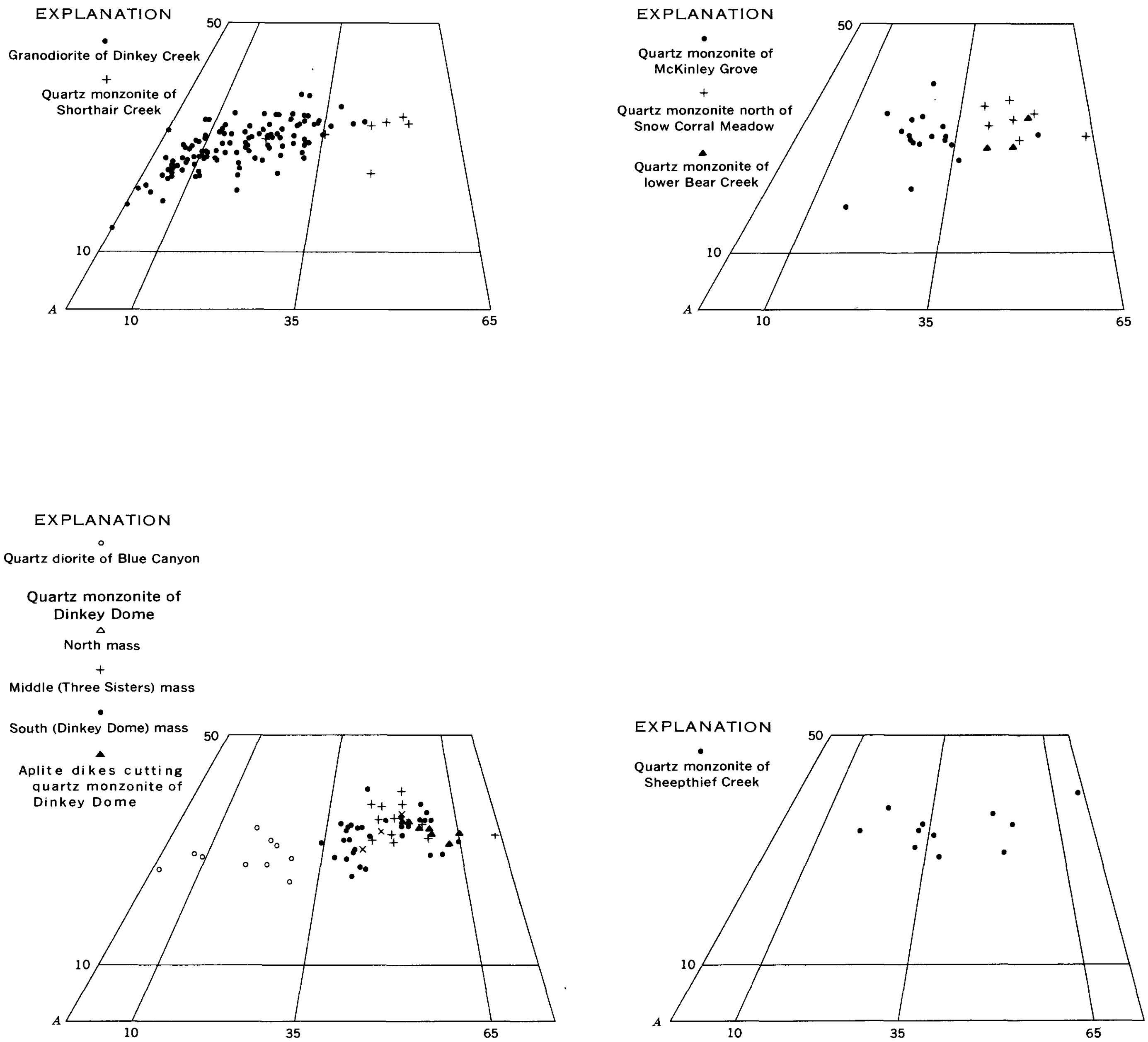

FIGURE 9. — Plot of modes for Lower Cretaceous granitic rocks.

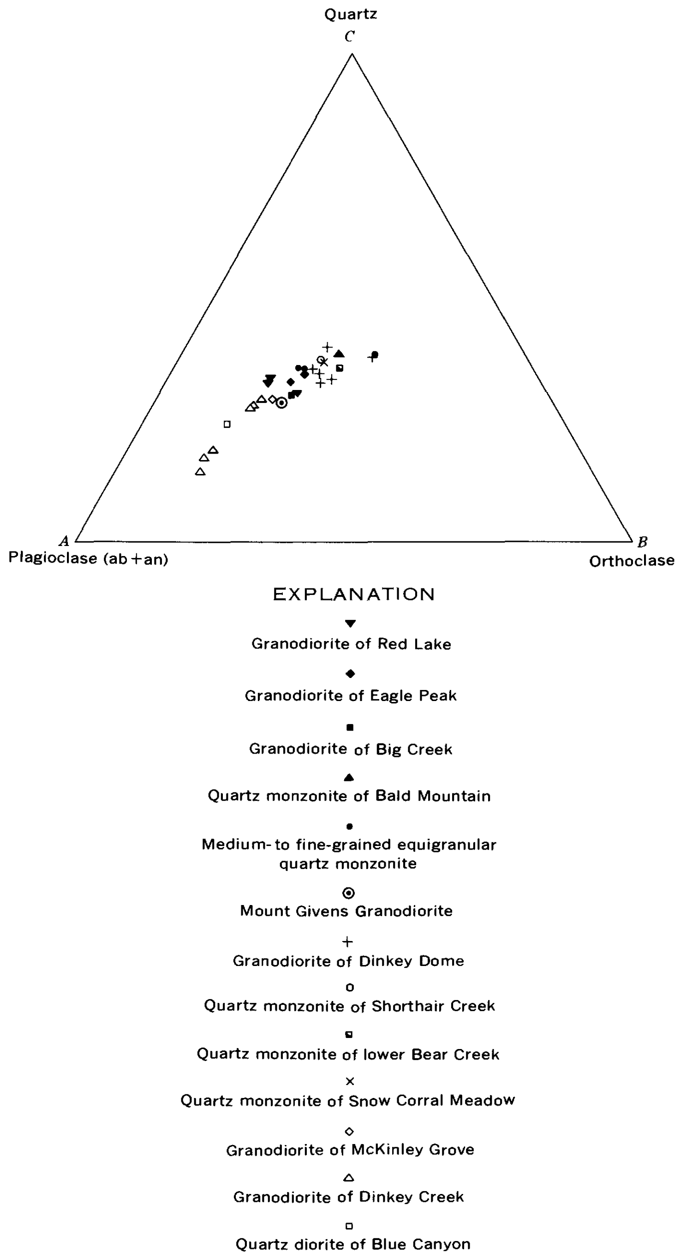

FIGURE 10. — Plot of norms for granitic rocks.

TABLE 1. — *Chemical and spectrographic analyses, norms, and modes of representative granitic rocks*

[Chemical analyses: Standard rock analysis of HL–29(1), by D. F. Powers. Rapid rock analyses for HL–4(1), by P. L. D. Elmore, Lowell Artis, Gillison Chloe, James Kelsey, S. D. Botts, J. L. Glenn, and Hezekiah Smith; for HL–4(2) and HL–9, by P. L. D. Elmore, S. D. Botts, Lowell Artis, J. L. Glenn, Gillison Chloe, Hezekiah Smith, and Dennis Taylor; for HL–29(2), by P. L. D. Elmore, S. D. Botts, and Lowell Artis; for all others, by Hezekiah Smith, J. L. Glenn, James Kelsey, Gillison Chloe, and P. L. D. Elmore. Semiquantitative spectrographic analysis of HL–29(1), by P. R. Barnett; for HL–29(2), by W. B. Crandell; for all others, by Chris Heropoulos: L = detected, but below limit of value given; N = not detected; looked for but not found, As, Au, Bi, Cd, Ge, Hf, In, Mo, Pd, Pt, Re, Sb, Ta, Te, Th, Tl, U, W, and Zn; looked for in samples that contain La or Ce but not found, Pr, Nd, Sm, Eu; values reported to the nearest number in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc., which represent midpoints of group data on a geometric scale, and the precision of a value is approximately plus or minus one bracket at 68 percent confidence or two brackets at 95 percent. Modal analyses by M. B. Norman, M. G. Hoerster, and O. G. Polovstoff: 1,000–2,000 point counts on a slab of at least 6 square inches]

	Quartz diorite of Blue Canyon	Granodiorite of Dinkey Creek							Granodiorite of McKinley Grove	
	HLc–58	HL–9	HLa–33	HLa–40	HLa–91	HLc–11	HLc–140	HLd–18	HLc–18	HLd–71
Chemical analyses (weight percent)										
SiO_2	63.1	66.3	67.5	66.5	69.6	60.1	59.2	57.4	65.5	66.9
Al_2O_3	16.7	16.1	15.1	15.5	15.3	17.2	17.6	17.8	16.1	16.2
Fe_2O_3	1.8	1.2	1.8	1.1	.88	2.1	2.0	2.3	1.4	.85
FeO	3.4	2.8	2.4	3.5	2.2	4.0	4.6	4.8	3.4	3.5
MgO	2.2	1.6	1.5	1.6	1.1	2.7	2.9	3.1	1.0	.63
CaO	5.0	4.6	3.7	4.2	3.0	5.9	6.2	6.7	3.0	3.4
Na_2O	3.3	3.2	2.7	3.0	2.7	3.3	3.2	3.1	3.4	3.8
K_2O	2.2	2.7	3.6	2.8	3.4	2.1	2.0	2.0	3.9	2.7
H_2O^+	.91	.67	.69	.84	.85	1.2	.80	1.2	1.4	.74
H_2O^-	.06	.07	.15	.10	.35	.18	.11	.16	.87	.11
TiO_2	.82	.54	.56	.63	.48	.91	.96	1.0	.59	.43
P_2O_5	.25	.14	.09	.15	.09	.22	.24	.25	.18	.16
MnO	.08	.07	.08	.08	.06	.11	.11	.12	.07	.08
CO_2	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Cl	...	...	...	...	...	...	...	...	...	...
F	...	...	...	...	...	...	...	...	...	...
Less O	...	...	...	...	...	...	...	...	...	...
Sum	100	100	99	100	100	100	100	100	100	100
Powder density (gm/cc)		2.75	...	...	...	...	...	...	...	...
Semiquantitative spectrographic analyses (parts per million)										
Ag	N	0.7	N	N	N	N	N	N	N	N
B	N	N	N	N	N	N	N	N	N	N
Ba	700	700	1,000	1,000	700	700	700	700	1,500	2,000
Be	N	1.5	N	1.5	1	N	N	N	1.5	1
Ce	N	N	N	N	N	N	N	N	100	150
Co	10	10	10	10	5	20	20	20	7	3
Cr	15	10	10	10	10	15	15	20	5	3
Cu	2	50	1	1	L.7	10	15	15	10	3
Ga	20	15	15	20	20	20	15	20	20	15
La	30	N	N	30	30	30	30	30	70	70
Li	N	N	N	N	N	N	N	N	N	N
Nb	10	10	10	10	10	10	10	10	20	10
Ni	5	5	2	1	2	7	7	7	N	N
Pb	30	30	15	15	20	15	30	7	10	15
Sc	15	10	15	15	5	20	20	20	15	15
Sn	N	N	N	N	N	N	N	N	N	N
Sr	1,000	500	500	500	500	700	700	700	500	500
V	100	70	100	70	50	150	150	150	30	15
Y	20	20	20	30	15	30	30	30	5	30
Yb	1.5	2	2	3	1	3	2	3	3	3
Zr	70	150	100	150	100	100	150	200	200	300
CIPW norms (weight percent)										
Q	20.6	24.0	27.2	25.3	31.9	15.3	11.6	13.9	24.9	24.5
C	.4	...	.3	.3	1.9	...	...	...	2.2	1.2
or	13.0	16.0	21.3	16.6	20.1	12.4	11.8	11.8	17.7	16.0
ab	28.0	27.1	22.9	25.4	22.8	27.9	26.3	27.1	28.8	32.3
an	23.2	21.6	17.8	19.9	14.3	25.9	28.8	27.8	13.7	15.9
hl	...	...	...	...	...	...	...	...	...	...
wo	...	.1	...	...	...	.8	1.2	.6	...	...
en	5.5	4.0	3.7	4.0	2.7	6.7	7.7	7.2	2.5	1.6
fs	3.6	4.4	2.1	4.6	2.6	4.3	5.5	5.4	4.2	5.2
mt	2.6	1.7	2.6	1.6	1.3	3.0	3.3	2.9	2.0	1.2
il	1.6	1.0	1.1	1.2	.9	1.7	1.9	1.8	1.1	.8
ap	.6	.3	.2	.4	.2	.5	.6	.6	.4	.4
fr	...	...	...	...	...	...	...	...	...	...
Total	99.1	99.2	99.2	99.3	98.7	98.5	98.7	79.1	97.5	99.1
Modes (volume percent)										
Quartz	23	31	28	23	26	18	17	17	27	26
Potassium feldspar	5	16	17	12	19	3	1	2	13	22
Plagioclase	51	36	39	48	43	57	61	53	45	42
Mafic minerals	21	16	16	17	12	22	21	28	15	11
Total	100	99	100	100	100	100	100	100	100	101
Bulk specific gravity	2.73	2.72	2.71	2.75	2.67	2.78	2.77	2.80	2.67	2.70

TABLE 1. — *Chemical and spectrographic analyses, norms,*

	Quartz monzonite of Dinkey Dome							Quartz monzonite of Shorthair Creek	Quartz monzonite of Lower Bear Creek	Quartz monzonite north of Snow Corral Meadow
	HL–29(1)	HL–29(2)	HLb–10	HLb–122	HLc–129	HLd–128	HLd–133	HLd–13	HLc–72	HLd–79
Chemical analyses (weight percent) — Continued										
SiO_2	78.37	75.4	73.1	76.3	73.0	76.9	72.8	73.1	73.7	73.7
Al_2O_3	11.73	13.5	13.7	13.1	15.0	13.1	14.6	14.3	14.2	13.7
Fe_2O_3	.33	.00	.64	.37	.33	.00	.43	.45	.59	.44
FeO	.74	.64	1.6	.40	1.7	1.1	1.7	1.5	1.1	1.6
MgO	.20	.1	.22	.05	.39	.04	.39	.56	.20	.41
CaO	.86	1.0	1.5	.59	1.4	.43	1.5	2.0	1.1	1.6
Na_2O	3.35	4.0	3.3	2.8	3.5	3.7	3.5	2.9	3.2	3.1
K_2O	3.31	4.6	4.7	5.7	4.2	4.1	4.0	4.2	4.8	4.3
H_2O^+	.25	.34	.53	.36	.50	.43	.65	.63	.63	.35
H_2O^-	.04	.04	.10	.05	.04	.07	.11	.10	.18	.15
TiO_2	.14	.15	.20	.05	.20	.02	.21	.23	.16	.24
P_2O_5	.02	.07	.06	.02	.10	.06	.10	.06	.05	.06
MnO	.05	.04	.05	.08	.08	.08	.08	.06	.02	.04
CO_2	....	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Cl	.01	....	....	....	....	....	....	....	....	....
F	.02	....	....	....	....	....	....	....	....	....
Less O	.01	....	....	....	....	....	....	....	....	....
Sum	99.41	100	100	100	....	100	100	100	100	100
Powder density (gm/cc)	2.67	....	....	....	....	....	....	....	....	....
Semiquantitative spectrographic analyses (parts per million) — Continued										
Ag	N	N	N	N	N	N	N	N	N	N
B	N	N	N	N	N	10	N	10	N	10
Ba	700	1,500	1,500	300	700	150	700	500	1,500	700
Be	1.5	1	2	N	5	5	7	2	1.5	N
Ce	N	N	N	N	N	N	N	N	100	N
Co	N	N	N	N	N	N	2	3	N	N
Cr	N	N	1	N	1	N	1	5	1	1
Cu	1.5	.3	7	1	L.7	L.7	L.7	1	7	L.7
Ga	7	10	20	10	20	20	20	15	15	15
La	70	30	50	N	30	N	N	N	50	N
Li	N	N	N	N	200	N	200	L200	N	N
Nb	15	10	10	N	15	15	15	7	15	7
Ni	N	N	N	N	N	N	N	N	N	N
Pb	30	20	20	70	15	30	30	70	30	30
Sc	N	N	10	N	5	3	5	3	7	N
Sn	N	N	N	N	7	5	7	N	N	N
Sr	300	150	300	50	200	20	200	200	200	200
V	N	7	N	N	7	N	10	20	N	15
Y	15	15	30	20	30	20	30	15	10	10
Yb	1.5	1.5	2	2	2	2	3	2	1	1.5
Zr	70	150	150	70	100	20	100	70	100	150
CIPW norms (weight percent) — Continued										
Q	44.08	32.0	31.7	36.7	31.9	37.9	32.4	34.2	33.6	34.4
C	1.19	.3	.6	1.3	2.4	1.9	2.0	1.5	1.9	1.2
or	19.68	27.2	27.9	33.7	24.7	24.2	23.6	24.8	28.4	25.5
ab	28.45	33.9	28.0	23.7	29.5	31.3	29.6	24.5	27.1	26.3
an	4.03	4.5	7.1	2.8	6.3	1.7	6.8	9.5	5.1	7.6
hl	.01	....	....	....	....	....	....	....	....	....
wo	....	....	....	....	....	....	....	....	....	....
en	.50	.3	.6	.1	1.0	.1	1.0	1.4	.5	1.0
fs	.95	1.0	2.2	.5	2.7	2.1	2.6	2.1	1.3	2.3
mt	.48	....	.9	.5	.5	....	.6	.7	.9	.6
il	.27	.3	.4	.1	.4	<.1	.4	.4	.3	.5
ap	.05	.2	.1	<.1	.2	.1	.2	.1	.1	.1
fr	.04	....	....	....	....	....	....	....	....	....
Total	99.73	99.7	99.5	99.5	99.6	99.5	99.4	99.2	99.2	99.5
Modes (volume percent) — Continued										
Quartz	39	....	33	32	32	34	28	31	33	32
Potassium feldspar	31	....	26	49	26	38	28	31	34	30
Plagioclase	28	....	38	18	36	25	39	33	32	34
Mafic minerals	3	....	3	1	6	3	5	6	2	5
Total	101	....	100	100	100	100	100	101	101	101
Bulk specific gravity	2.57	....	2.64	2.61	2.65	2.64	2.62	2.62	2.62	2.64

and modes of representative granitic rocks — Continued

Mount Givens Granodiorite	Granodiorite of Red Lake				Granodiorite of Eagle Peak		Granodiorite of Big Creek	Quartz monzonite of Bald Mountain	Medium- to fine-grained quartz monzonite	
HLb-61	HL-4(1)	HL-4(2)	HLa-30	HLa-111	HLd-5	HLd-51	HLa-62	HLc-2	HLb-114	HLd-61
Chemical analyses (weight percent) — Continued										
66.8	68.6	70.0	69.7	68.3	68.3	70.9	69.7	75.3	73.6	73.2
15.6	16.0	15.2	15.5	15.8	15.9	15.2	14.7	13.5	14.1	13.5
1.7	1.9	1.3	.39	1.3	1.8	1.0	.65	.19	.73	1.4
2.3	1.6	1.4	2.1	2.0	2.3	1.5	2.5	.92	.88	1.3
1.6	.92	.90	.74	1.2	1.1	.67	1.2	.15	.44	.52
3.7	3.0	3.3	2.8	3.1	3.1	2.5	3.1	1.1	1.5	1.1
3.0	3.3	3.7	3.3	3.4	3.0	3.1	3.2	3.1	3.7	2.3
3.4	3.0	2.8	3.8	2.8	3.4	3.8	3.7	4.6	3.8	5.5
.93	.50	.57	.80	1.0	.73	.64	.44	.66	.67	.68
.17	.12	.07	.13	.31	.09	.07	.08	.15	.11	.14
.59	.51	.46	.47	.52	.53	.36	.48	.09	.21	.27
.16	.24	.16	.14	.12	.15	.12	.11	.04	.09	.07
.08	.11	.05	.05	.08	.07	.04	.05	.04	.05	.07
<.05	.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....
100	100	100	100	100	100	100	100	100	100	100
....	....	2.65	....	....	....	....	....	....	....	....
Semiquantitative spectrographic analyses (parts per million) — Continued										
N	N	0.7	N	N	1	N	N	N	0.7	N
N	10	N	N	N	N	N	N	N	N	10
700	1,000	1,000	1,500	1,500	1,500	1,500	1,500	700	1,500	300
N	1.5	2	N	N	1	1.5	2	3	2	N
N	N	70	N	100	100	N	70	N	100	N
10	5	10	3	7	7	3	7	N	N	3
10	2	3	1.5	5	3	3	10	5	1	1.5
7	3	5	10	2	1	2	.7	.7	1	2
15	15	15	20	20	20	20	20	15	15	15
N	30	30	30	50	50	N	50	N	50	N
N	N	N	N	N	N	N	N	L200	N	N
15	10	10	10	N	7	10	10	7	10	N
2	N	2	N	1	N	N	2	N	N	N
30	20	.30	20	15	30	30	20	10	50	50
10	5	3	5	7	7	3	7	N	N	3
N	N	N	N	N	N	N	N	N	N	N
500	1,000	700	700	700	700	700	500	150	500	150
100	50	50	30	50	50	30	50	5	20	15
20	10	10	15	10	15	15	20	10	10	N
2	1	1	1	1	2	1	1.5	.7	.7	7
100	300	150	150	150	150	150	100	50	150	100
CIPW norms (weight percent) — Continued										
25.6	30.5	29.5	28.0	28.9	28.9	31.7	27.3	36.6	33.6	35.4
.6	2.4	.5	1.2	1.8	2.0	1.7	.1	1.5	1.4	1.9
20.1	17.8	16.6	22.5	16.6	20.0	22.5	21.9	27.2	22.5	32.5
25.4	28.0	31.3	27.9	28.8	25.3	26.3	27.1	26.3	31.3	19.5
17.3	13.3	15.3	13.0	14.6	14.3	11.6	14.7	5.2	6.9	5.0
....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....
4.0	2.3	2.2	1.8	3.0	2.7	1.7	3.0	.4	1.1	1.3
2.0	.7	.8	2.9	1.9	2.0	1.4	3.4	1.5	.8	.9
2.5	2.8	1.9	.6	1.9	2.6	1.5	.9	.3	1.1	2.0
1.1	1.0	.9	.9	1.0	1.0	.7	.9	.2	.4	.5
.4	.6	.4	.3	.3	.4	.3	.3	.1	.2	.2
....	....	....	....	....	....	....	....	....	....	....
99.0	99.4	99.4	99.1	98.8	99.2	99.4	99.6	99.3	99.3	99.2
Modes (volume percent) — Continued										
27	28	....	26	19	27	28	30	31	29	32
19	14	....	15	26	18	28	20	34	28	40
41	50	....	50	46	50	37	40	33	40	24
13	9	....	9	9	5	6	10	2	3	5
100	101	....	100	100	100	99	100	100	100	101
2.69	2.67	....	2.67	2.67	2.70	2.65	2.68	2.61	2.63	2.63

TABLE 2. — *Potassium-argon age determinations on biotite and hornblende from granitic rocks of the Huntington Lake quadrangle*

[Determinations for HL–4, HL–29, and HL–9 from Kistler, Bateman, and Brannock (1965, p. 158, table 1). Determinations for other samples are by R. W. Kistler; K analyses by Lois Schlocker. $\lambda\beta=4.72\times10^{-10}$ year^{-1}; $\lambda\epsilon=0.584\times10^{-10}$ year^{-1}; 1.19×10^{-4} atoms K^{40}/atoms K. Estimated uncertainty (due to analytic uncertainties of potassium and argon) of each age at the 68-percent confidence level is ±3.0 percent]

Specimen	Rock unit	Mineral	K (weight percent)	r Ar^{40} (moles/g $\times 10^{-11}$)	Age (m.y.)	Percentage of radiogenic Ar
HL–4	Granodiorite of Red Lake	Biotite	7.12	106.3	82	85
HLa–80	do	do	7.31	117.43	88.3	89
HLd–6	Granodiorite of Eagle Peak	do	6.88	108.48	86.7	95
HLa–46	Granodiorite of Big Creek	do	7.58	118.87	86.3	89
HLa–16	Quartz monzonite of Bald Mountain.	do	7.42	120.06	88.9	84
HL–29	Quartz monzonite of Dinkey Dome.	do	6.77	102.5	83	57
HLc–126	do	do	7.79	124.15	87.6	98
HLd–102	do	do	7.79	123.77	87.5	92
HLc–68	Quartz monzonite of lower Bear Creek.	do	7.26	119.35	90.3	94
HLd–20	Quartz monzonite north of Snow Corral Meadow.	do	6.67	105.11	86.6	88
HL–9	Granodiorite of Dinkey Creek	do	7.46	112.3	83	76
		Hornblende	.83	13.35	88	78

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